Continental J. Biological Sciences 2: 1 - 6, 2009

PHYTOPLANKTON COMMUNITY OF LAKE GBEDIKERE, BASSA, KOGI STATE, NIGERIA

Adeyemi, S.O[1], Bankole, N.O[2], Adikwu, I.A.,[1] Akombu, P.M[1]., Okpanachi, M.A.[1] and A. Abubakar[2].
[1]Department of Biological Sciences, Benue State University, Makurdi. [2]Department of Biological Sciences, Kogi State University, Anyigba.

ABSTRACT
The study on the Physico-Chemical characteristics and Phytoplanktons of Lake Gbedikere was carried out between June and December, 2008. The study showed notable seasonal variation in the component investigated. Temperature seemed a major determinant of the composition, abundance and seasonal variation of encountered lake biota. During the study four (4) taxa of Phytoplankton existed in the lake as at the time of the study viz: Chlorophyta, Bacillariophyta, Cryptophyta and Euglenophyta. A total of 1,302 Phytoplanktons were counted with Chlorophyta having the highest percentage dominance of (77.74%), Bacillariophyta (18.81%), Cryptophyta and Euglenophyta (3%) each respectively. The status of the lake could said to be eutrophic as indicated by the diversity of planktons.

KEYWORDS: Gbedikere lake, phytoplankton, physico-chemical, seasonal variation.

INTRODUCTION

The physico-chemical characteristic of a lake depends on the following; Lake size, shape, topography, climate, biological community and anthropogenic activity, lakes vary physically in terms of temperature, water current and transparency. Chemically; they vary in major ions, minor ions, nutrients and contaminants.

Many works have been carried out globally on water bodies as regards the study of phytoplankton and water quality assessment. Allen, (1980) reported that the most obvious consequences of eutrophication in River Hadejia is the accelerated growth and proliferation of planktonic algae which reduces their aesthetic and recreational values and limit their usefulness as source of domestic water supply an any biological production. Palmer, (1980) also reported that the population of planktons in water undergoes variation both in structure and function related to the physico-chemical changes in their environment. (Ado, *et.al.* 2004) revealed on his study of the ecology of fresh water phytoplankton of River Hadeija, that there was variation in the abundance and distribution of algae population with the variation of the physico-chemical factors. More over on the seasonality of phytoplankton, he also observed that phytoplankton occurred in higher densities during the dry season than the rainy season.

Koening and Eskinazi-leca, (1985) described phytoplankton as photosynthetic organisms measuring from <5 micrometre to >700 micrometre. Their role in food web is to provide proteins, carbohydrates, fats, minerals and vitamins to other organisms. Sufficient nutrient and suitable ecological conditions play important role in their availability and abundance. It has been reported that phytoplankton abundance in an aquatic ecosystem results in increased fish production (Shah and Chughtai, 1992; Shah, *et.al.* 2000).

Phytoplankton like *Scenesdesmus* and *Chlorella* species are considered to serve as suitable food for mass production of rotifers (Fukusho, 1989). The excessive abundance or blooming of eutrophic species of phytoplankton has detrimental effect on the domestic industrial and recreational uses of water and is in many cases a direct motivation for restorative measures (Bryant, 1994).

Reynolds, (1981) reported that, although phytoplankton species composition and diversity changes with environmental conditions such as nutrients level, temperature, light and predator pressure etc. the relative importance of these factors varies considerably among different taxa under conditions of nutrient enrichment or eutrophication, the blue green algae are known to proliferate and form noxious blooms in fresh water environments. The development of phytoplankton blooms in eutrophic lakes is attributed to their ability to accommodate reduced nitrogen to phosphorus ratios, low edibility due to their large colony sizes coupled with

large herbivore regulation of other taxa (Barica, 1994). The formation of algae blooms also depends on retention time, type and algae of water body as well as calm weather conditions with low turbulence of water (Bucka, 1989).

The primary production of organic matter in the forms of phytoplankton is more extent in lakes than in rivers due to their lentic state. The study of the phytoplankton of a lake can not be carried out without assessing the physico-chemical parameters of the lake because a relationship exist between the phytoplankton and these environmental parameters, their abundance or scarcity will in turn lead to the distribution, abundance or scarcity of these water plants.

MATERIALS AND METHODS

STUDY AREA

Lake Gbedikere is a natural lake located between Latitudes $3^0 24^0$ and Longitudes $5^0 14^E$ and is about 10km to the East of Oguma the Head quarter of Bassa Local Government Area of Kogi State.

Water enters the Lake from tributaries that run from River Benue during rainy or flood season. When the season is over, the Lake separates out. The Lake is about 450m north of Gbedikere village. The water body covers about 400 – 450m and a depth of 10 – 14m deep, depending on the season.

The Lake is used for fishing and other domestic activities; consequently most of the settlers around the Lake are fishermen (Upper Benue River Basin Development Authority, 1985). The lake experience two seasonal periods; the rainy season starts in the month of May and last till October and is characterized by heavy down pour which sometimes have an extensive flood action. The dry season is from late October to April and is characterized by cold, dusty -dry wind followed by intense heat. The lake contains fish, other aquatic animals and some macrophytes such as wire grass (*Cyperus articulatus*) which are used for waving mats.

WATER SAMPLING

Water samples were collected between 9.00am and 10.00am every forth nightly. The water samples were collected from three different points on the lake namely: the lower course, middle course and the upper course labeled stations A, B and C respectively. Parameters such as temperature and transparency were analyzed at the lake site. Water samples were transported to the laboratory for further analysis of pH and dissolve Oxygen and the mean reading was recorded.

PHYTOPLANKTON SAMPLING

Phytoplanktons were collected with bottling silk plankton net with a collecting bottle at the base. At each of the three stations, the net was immersed just below the water surface and then bowed through a distance of 5m along the side of the boat. The content of the bottle was then poured into a sampling bottle and preserved in 4% formalin (Akin, 2001). About 10ml of the water collected in the 250ml sampling bottles was taken and put into petri dish. This was taken drop by drop on to glass slide and observed under the microscope.

PHYTOPLANKTON ANALYSIS

Water sample was taken drop by drop and observed under microscope and the number of cells present was counted using the Hau seer raftle cell counting chamber. Identification of algae species was carried out based on morphological features according to Palmer, (1980).

RESULTS

The physical and chemical factors on the abundance and distribution of the phytoplankton of Gbedikere Lake shows that temperature ranged between $25.3^oC – 29.3^oC$ while transparency, dissolved oxygen and pH ranged between 0.30 – 0.35, 4.69min – $5.21mgl^{-1}$ and 6.02 – 7.21 respectively (Table 1).

Table 1: Mean Variations in Physico-Chemical Parameters of Gbedikere Lake, Bassa, Kogi State.

Wks	Date	^oC	M	mgl^{-1}	pH
1	6.8.2008	29.3	0.33	4.80	7.00
2	13.8.2008	29	0.34	4.48	6.02
3	20.8.2008	29	0.34	5.21	6.02
4	27.8.2008	27.3	0.35	4.86	7.21
5	3.9.2008	26.6	0.32	4.83	6.97
6	10.9.2008	28	0.33	4.69	6.13
7	17.9.2008	25.3	0.33	4.83	6.65
8	24.9.2008	28.3	0.31	4.80	6.03
9	1.10.2008	28.3	0.33	5.02	6.42
10	8.10.2008	28	0.30	5.12	6.94

The total number of phytoplanktons recorded was one thousand three hundred and two (1,302) Algae population densities were recorded (Table 2, 3 and 4). The result shows that station A had the highest number of algal cells and this is due to anthropogenic activities which takes place close to the sampling station (Table 2).

Table 2: Variation in Phytoplankton Abundance of Station A.

Wks	Chlorophyta	Baccillariophyta	Cryptophyta	Euglenophyta	Total
1	58	15	2	2	78
2	54	4	4	4	66
3	42	11	-	-	53
4	48	4	-	2	54
5	42	10	3	-	55
6	33	13	2	2	50
7	40	10	4	2	56
8	50	10	-	1	61
9	34	13	-	4	51
10	37	12	2	1	52

Station C had the least number of algal cell counts because no form of human activities takes place there except fishing (Table 4)

Table 3: Variation in Phytoplankton abundance at station B

Weeks	Chlorophyta	Bacillariophyta	Crytophyta	Euglenophyta	Total
1	49	11	-	-	60
2	32	12	2	-	46
3	44	10	1	1	56
4	38	1	1	-	40
5	24	5	2	2	33
6	28	8	-	2	38
7	35	7	-	-	42
8	37	10	2	3	52
9	16	7	3	2	28
10	25	5	1	2	33
Total	238	76	12	12	428

Table 4: Variation of phytoplankton abundance of Station C.

Wks	Chlorophyta	Bacillariophyta	Cryptophyta	Euglenophyta	Total
1	22	10	2	2	36
2	18	6	2	-	26
3	12	4	-	1	17
4	25	1	1	1	17
5	24	9	4	4	41
6	24	7	-	2	33
7	30	9	-	2	41
8	23	7	2	3	35
9	16	5	1	1	23
10	13	3	1	1	18
Total	207	61	13	17	298

The total numbers of 14 species of phytoplanktons were identified. The four major divisions of algae collected and identified during the study include Chlorophyta, Bicillariophyta, Cryptophyta and Euglenophyta. Chlorophyta species were most abundant and accounted for 74.74% of the total species of algae examined, and the most dominant members *Ulothrix* species and *Actinastrum* species with relative percentage occurrence of 11.29 and 9.91 respectively.

Bacillariophyta accounted for 19% of the total number of phytoplankton identified; the results indicated that the species of *Gyrosigma* were the most dominant of all the Bacillariophyta identified during the study period.

Cryptophyta and Euglenophyta were the least among the phytoplanktons identified; they comprise of 3% each (Table 5).

DISCUSSION AND CONCLUSION

The population of phytoplankton in water undergoes variation both in structure and function related to the physico-chemical changes in their environment (Palmer, 1980). A similar observation of the effect of physical and chemical factors on the abundance and distribution of phytoplankton in Gbadikere Lake show that temperature plays a very important role. The temperature recorded during the period of study correspond with that of Grass *et.al.*, (1987) which reports on the limnilogical investigation of the River Nile, this also is inline with the findings of Awadallah, *et.al.,* (1989).

The growth and reproduction of phytoplankton are affected by the hydrogen ion concentration of the surrounding water. The pH range recorded during the study period showed that the water is portable for drinking and can support aquatic life (FEPA, 1991).

The value of dissolved oxygen content of the lake falls within the range of 4.69 mgl^{-1} – 5.21mgl^{-1} which is inline with the findings of Ado, *et.al.* (2004). The results have also shown that high phytoplankton density corresponded with high dissolve oxygen content, this is also in agreement with the findings of Jana, (1974).

The low transparency values recorded could be attributed to the muddy nature of the soil in the study area. Due to sparse vegetation around the lake, the lake is open to wind and wave action which mix the bottom sediment resulting in re-suspension of particles (Palmer, 1980).

Conclusively, Gbedikere Lake contains a variety of phytoplankton species which represents some of the major divisions of algae including Chlorophyta and Euglenophyta. Of all the species identified during the period of study, Chlorophyta species were the most dominant of all the phytoplanktons observed. There was variation in the abundance and distribution of algae population with the variation of the physico-chemical factor during the period of study.

Table 5: Phytoplankton relative abundance (%) in Gbedikere Lake.

	Station A	Station B	Station C	Total	% within division	% in entire community
Chlorophyta						
Actinastrum	67	38	24	129	13.26	9.91
Chlorella	44	45	24	113	11.61	8.68
Pteromonas	57	44	24	125	12.85	9.60
Ulothrix	60	51	36	147	15.11	11.29
Eudorina	59	38	18	115	11.82	8.83
Stichococcus	42	38	18	98	10.07	7.53
Ankistrodesmus	47	26	23	96	9.87	7.53
Pandorina	23	20	18	61	6.27	4.69
Chlorogonium	39	28	22	89	9.15	6.84
Total	438	328	207	973		
Bacillariophyta						
Closterium	27	24	17	68	27.76	5.22
Gyrosigma	43	24	23	96	36.73	6.91
Diatoma	38	28	21	87	35.51	6.68
Total	108	76	61	245		
Cryptophyta						
Tetraedon	14	12	13	39	100	3.00
Euglenophyta						
Euglena	16	12	17	45	100	3.46
Total				1, 302		

REFERENCES

Ado, I.Y; Adikwu, I.A; Abdullahi, B.A. (2004). Studies on Limnological Parameters and Phytoplankton Dynamics in Some Borrow Pit Ponds in Kano Metropolitan area, Nigeria. *Best Journal 1 (1):* 124 – 133pp

Allen, V.K (1980) Mans Impact On The Global Environment. *Second Annual Report of the Council on Environmental Quality*. Washington DC p25.

Akin, G.A (2001): Phytoplankton of Awba Reserve, Ibadan, Nigeria. *Rev. Biol. Trop.* 51(1): 99-106.

Barica, J. (1994). How to keep green algae in Eutrophic Lakes. *Biology* 49 (4): 611-614.

Bucka (1989): Tropic Relations Between Phytoplankton And Zooplankton In A Field Experiment In The Aspect Of Formation And Decline Of Water Blooms ACTA.

Bryant, D.A. (1994). The Molecular Biology of Cyanobacteria Kluwer. 881pp.

FEPA, (1991). National Interim Guidelines and Standards for Environmental Pollution in Nigeria. Federal Environmental Protection Agency. 54-58.

Fukusho, K. (1989): Biology and Mass Production of rotifer. *Int. J. Aquatic Fish Technol 10*: 232-240.

Grass, R.H.A and Leceque, D.S.A. (1987). Le plankton du bas chari el dele partie est su lat Chad. *Hydrobiol.* 1(4): 25-26.

Jana, B.B. (1974): Durnal elythim of plankton in a tropical fresh water pond in sanatiniketan *India. Ekol* 22:287-294

Koenign and Esknazi-leca, (1985). Relative Abundance of Planktonic Life in Relation to Water Quality. *Online Journal of Biological Sciences* 3(7):635.

Palmer, G.M. (1980): Algae and Water Pollution. *Castle House Publication,* England p.123.

Reynolds, C.S., Jaworski, G.H.M. (1981). Annual Cycle of the Blue-Green Alga, *Microcystis Aeruginos Kutz. Emend. Proc. R. Soc. Lond. B.Biol. Sci.* 293:419-477.

Shah, K. (2000). Some Observations of the Dissolve Solids of Surface Waters and the Effects of Conductivity on the Growth of Algae. *J. New England Way. Wks. Ass.* 14: 1-25.

Shah, K and Chughtai, I. (1992). Relative Abundance of Planktonic life in Relation to Water Quality Parameters in Non-Polluted gone of Deg Nullah. *Online Journal of Biological Sciences* 3(7):635.

Upper Benue River Basin Development Authority, (1985): Feasibility study of Lake Geriyo by Upper Benue River Basin Development Authority. Authority Information Manual.

Received for Publication: 17/04/2009
Accepted for Publication: 13/05/2009

Corresponding Author (Present Address)
Adeyemi, S.O
Department of Biological Sciences, Kogi State University, Anyigba.
Email: sadeyemi2003@yahoo.com